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February 11, 2000

Ms. Wendy R. Dixon  
EIS Project Director  
Office of Civilian Radioactive Waste Management  
Yucca Mountain Site Characterization Office  
P.O. Box 30307, M/S 010  
North Las Vegas, NV 89036-0307

Dear Ms. Dixon:

In accordance with the National Environmental Policy Act (NEPA), Section 309 of the Clean Air Act, and the Council on Environmental Quality's implementing regulations (40 CFR 1500-1508), the Environmental Protection Agency (EPA) is providing you comments on the Draft Environmental Impact Statement (EIS) for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada, dated July 1999 (DOE/EIS-0250D, CEQ# 990282).

The Proposed Action addressed in the draft EIS is to construct, operate, monitor, and eventually close a geologic repository at Yucca Mountain in southern Nevada for the disposal of spent nuclear fuel and high-level radioactive waste currently in storage at 72 commercial and five Department of Energy (DOE) sites across the nation.

As outlined in this letter and accompanying detailed comments, EPA is seeking a number of clarifications about and additional data on the environmental impacts of the proposed project. We expect that DOE will be able to provide this information and enable EPA to fully assess the project's impacts. EPA is therefore rating the Yucca Mountain EIS as "EC-2", Environmental Concerns-Insufficient Information. EPA's major issues are summarized below, and our detailed comments are enclosed.

- 1 [EPA commends DOE for what is generally a well-organized and plain English document  
2... on a highly complex subject.] However, [EPA could not always find data or explanations to  
support the conclusions drawn. A prime example of this is that EPA found insufficient data to  
support the prediction of the movement of radionuclides in the saturated zone beneath the  
repository. These data are needed to determine if the facility's performance will satisfy  
applicable radiation standards designed to protect ground water resources and public water

2 cont. [supplies. As you know, EPA has proposed standards applicable to Yucca Mountain.]

The draft EIS acknowledges that on-going studies at the proposed repository site and the continuing investigations of engineered barriers and waste package designs are not scheduled to be completed until after the submission of the final EIS. The continuing site characterization and data collection raise questions about whether a supplemental environmental impact statement will be needed once the final design and waste content are determined. CEQ regulations (sec. 1502.9) require a supplement to a draft or final EIS when there are substantial changes to a proposed action relevant to environmental concerns or where there are significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impact.

If the Department's subsequent analysis of design choices indicates that the draft EIS/final EIS bounded the potential impacts, a supplemental draft and/or final EIS may not be needed. However, even if not strictly required by NEPA, a supplemental EIS or another document subject to public review and comment may be advisable given the potentially significant changes in final design and waste content. At a minimum, the final EIS must describe the changes from the draft EIS and update the discussion of impacts on the environment and public health. Our detailed comments provide examples of areas of uncertainty which lead to this conclusion.

3... [EPA devoted considerable attention to the no-action alternatives and noted the public controversy about how realistic these are.] EPA agrees that aspects of the no-action alternatives are speculative. However, the agency also believes that they provide a basis for comparison with the preferred alternative for the purposes of NEPA. We caution DOE, however, that should the U.S. decide not to proceed with constructing and operating the repository at Yucca Mountain and to pursue another solution, DOE would need to do a full examination of alternatives and their environmental impacts, within the confines of any national legislation.

EPA's review also focused on the national transportation aspects of this project. EPA appreciates that the actual shipments of waste will not likely occur for another 10 years and understands DOE's reluctance to provide additional information on routes for waste transport. However, EPA sees no reason why DOE cannot commit to making this information available as the time for shipments approaches, as the Department is doing now for shipments to the Waste Isolation Pilot Plant in New Mexico. Once DOE has greater certainty about the routes along which waste shipments will travel, the Department will also be able to update and expand upon, if needed, the environmental justice or other route-specific impact analyses. Specifically with regard to tribal governments, EPA encourages DOE to conduct a comprehensive tribal consultation process wherever waste shipments may cross tribal lands.

In addition, EPA suggests that the final EIS provide a section which lays out the responsibilities of various federal, state, local and tribal agencies in regulating, approving and monitoring shipments of radioactive waste. This information should provide additional

assurance to the public that a national network of controls is in place designed to ensure public safety.

Thank you for the opportunity to review this document. If you have any questions or would like to meet to discuss our comments further, please contact Susan Absher of my staff. She may be reached at 202/564-7151.

Sincerely,



Richard E. Sanderson  
Director  
Office of Federal Activities

Enclosures: 2  
Summary of Rating Definitions  
Detailed EPA comments on the draft EIS

**DETAILED EPA COMMENTS on  
Draft EIS for a Geologic Repository for the Disposal of Spent Nuclear Fuel  
and High-Level Radioactive Waste at Yucca Mountain  
(DOE/EIS-0250D, July 1999)**

**Section 1. Purpose and Need for Agency Action**

- 4 Section 1.2.3, page 1-7. The second full paragraph describes the treatment process for high-level waste from storage in waste tanks through solidification. Part of that process "ordinarily includes separation of the waste into high-activity and low-activity fractions." However, after describing what happens to the "high-activity fraction," there is no mention of what happens with the "low-activity fraction." The low-activity fraction is still high-level waste, and this discussion should include the disposition of the low-activity fraction.

**Section 2. Proposed Action and No-action Alternative**

No-Action Alternative

- 3 cont. Section 2.2, page 2-59: This section describes the no-action alternative (no further site characterization at Yucca Mountain) and lays out two scenarios for this alternative: (1) wastes are stored at current locations and monitored/maintained for 10,000 years; or, (2) wastes are maintained for only 100 years, after which they are assumed to be abandoned. The Draft EIS acknowledges (page 2-60) that should there be a decision not to proceed with the repository, neither of these scenarios is likely; rather, the scenarios were chosen to provide a basis of comparison with the proposed action.

EPA agrees that while aspects of the no-action alternatives are speculative, they do provide a basis for comparison with the preferred alternative for the purposes of NEPA. We caution DOE, however, that should the U.S. decide not to proceed with constructing and operating the repository at Yucca Mountain, DOE would need to do a full examination of alternative solutions and their environmental impacts, within the confines of any national legislation.

Evolving Design of the Repository: General Comments

- 5... Page 2-6 indicates that there are many uncertainties about the final design of the repository and several of its components:

"This EIS describes and evaluates the current preliminary design concept for repository surface facilities, subsurface facilities and disposal containers."

"Plans for the repository would continue to evolve during the development of the final repository design and as a result of the NRC licensing review."

"For these reasons, DOE developed implementing alternatives and analytical scenarios to bound the environmental impacts likely to result from the Proposed Action."

5 cont.

Page 2-10 states:

"DOE continues to investigate design options . . . for final repository design; Appendix E identifies design features and alternative design concepts that DOE is considering for the final design (for example, smaller waste packages, a waste package design using two corrosion-resistant materials . . .). . . . DOE has assessed each of the design options still being considered for the expected change it would have on short- and long-term environmental impacts and has compared these impacts to the potential impacts determined for the packaging, thermal load and transportation scenarios evaluated in the EIS. . . DOE has concluded that the analytical scenarios and implementing alternatives evaluated in this EIS provide a representational range of potential environmental impacts the Proposed Action could cause."

The continuing site characterization and data collection raise questions about whether a supplemental environmental impact statement (SEIS) is needed once the final design and waste content are determined. CEQ regulations (sec. 1502.9) require a supplement to a draft or final EIS when there are substantial changes to a proposed action relevant to environmental concerns or where there are significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impact.

If the Department's subsequent analysis of design choices indicates that the draft EIS/final EIS bounded the potential impacts, a supplemental may not be needed. However, even if a supplemental is not strictly required by NEPA, a supplemental or other document subject to public review and comment may be advisable given the potentially significant changes in final design and waste content. At a minimum, the final EIS must describe the changes from the draft EIS and update the discussion of impacts on the environment and public health. Examples of areas of uncertainty which lead to this conclusion are given below in the comments referring to pages 2-6, 2-10, 2-32, 2-37 (Section 2.1.2.4), and 2-81.

#### Evolving Design of the Repository: Specific Comments

- 6 Page 2-6, final two paragraphs of 2.1.1: The repository performance and dose assessments in the draft EIS are based on models and assumptions in the DOE Viability Assessment Report (DOE/VA - DOE/RW-0508) that are now outdated. For example, the draft EIS analyzes the Module I & II inventory increases which were not part of the DOE/VA. Also, the DOE/VA examined the performance of a waste package design that is now obsolete. The assessments in the final EIS should describe/assess the new EDA II design, particularly those aspects of the new design that modify the performance assessment.
- 7 Page 2-17, Figure 2-10 does not identify the proposed locations for the cask maintenance facility and landfill. Locations of these need to be identified in order to assess their potential impacts.
- 8... Page 2-21, 2.1.2.1.5: The second paragraph mentions "water used for cooling tower operations." We found no other description or reference to a cooling tower. The final EIS should explain the purpose of this operation and any possible radiological or chemical contamination from the

- 8 cont. cooling tower.
- 9 Page 2-31: The third full paragraph describes removing materials from the repository during subsurface construction that occurs simultaneously with waste emplacement. What plans does the Department have for monitoring the water and other material being removed during waste emplacement operations? Monitoring should ascertain that no radioactive contamination is being removed. While it is not likely that such contamination will occur, there is always the possibility of contaminants adhering to the surface of waste packages and getting into the water or material being removed, or of an accident occurring.
- 10 Page 2-32: The second paragraph contains a general description of the waste package used for the performance assessment. The description of the waste package must be updated in the Final EIS.
- 11 Page 2-37, Section 2.1.2.3. In the final paragraph, the statement that DOE would use institutional controls "to limit or prevent intentional and unintentional activities in and around the closed repository" is problematic. EPA and the National Academy of Sciences maintain that prevention of such activities, including intrusion into the repository, cannot be assumed once active controls are discontinued. Since this paragraph refers to time beyond any reasonable active control period, e.g., more than 100 years, it should be amended to read "to attempt to limit intentional and unintentional activities...." Second, this paragraph states, "Provisions could be added for post-closure monitoring." The final EIS should elaborate on when and how DOE would add post-closure monitoring.
- 12
- 13 Page 2-37, Section 2.1.2.4, first paragraph: When does the Department expect to have a performance confirmation program in place, and how will DOE decide which data to evaluate? We note that this paragraph says that the "performance confirmation programs could include" the listed data types. [emphasis added] EPA recommends using all of these factors to improve the performance assessment.
- 14 Page 2-40, Section 2.1.3.2, first paragraph: Please confirm whether only heavy-haul trucks will be used from commercial sites, or if legal-weight trucks may also be used.
- 90 Page 2-58, Section 2.1.4.3: This discussion does little to help the reader understand the design features and alternatives that affect operations and costs. We note that DOE intends to "evaluate the environmental impacts associated with the updated design in the final EIS." This section should be revised to clarify the discussion.
- 15... Page 2-58, Section 2.1.5: The discussion of "estimated costs" provides broad cost categories without an explanation of how these were derived. Also, there is no indication of how costs occur over time; no indication of the discount rate used to present all costs in 1998 dollars; and no indication of whether these are all direct costs of construction or if they include indirect costs such as that for siting the repository. TRW 1999e, the draft EIS cost summary report, is cited, but the final EIS should provide the reader more detail on costs.
- Page 2-67, Section 2.2.3: The comments for section 2.1.5 apply here also. In addition, Table 2-6

- 15 cont. provides only limited information and leaves out how storage costs were developed and how these compare to industry estimates.
- 16 Page 2-74, Section 2.4.3, first paragraph: The last sentence indicates that long-term (100 to 10,000 years) impacts were assessed only where DOE "could establish estimates of impacts." Were there any important impacts which were not assessed for this reason? If so, how does DOE plan to address them? (See 40 CFR § 1502.22)
- 17 Page 2-80, Table 2-8: It appears that the dose equivalent listed in this table for the maximally exposed member of the public (2.4 rem) is an annual value. If so, EPA assumes this value is listed in error. While EPA does not have transportation standards, compare this value to the limit for exposure to individuals of 0.015 rem per year (40 CFR Part 191) during the post-closure period of a repository.
- 18 Page 2-80, Section 2.4.4.1, last paragraph: Please explain the conclusions that short-term impacts would be less than a factor of 2 for thermal-load scenarios and that the impacts would be highest for the low thermal load and lowest for the high thermal load scenario.
- 19 Page 2-81, Section 2.4.4.2, final bullet: This item should refer to the Section 6 discussion of assessing impacts on cultural resources of Native Americans.

### Section 3. Affected Environment

#### General Ground Water Issues

- 20 Section 3 of the draft EIS provides information about the hydrogeologic conditions in the vicinity of Yucca Mountain. The certainty of this information varies considerably, and it is difficult for the reader to understand how uncertainties will be resolved and how the data still being gathered will affect the design of the repository and the projections for ground water contamination. EPA suggests that the final EIS summarize ongoing studies and their expected impact on design and on ground water quality projections.
- 21 Most of the ground water studies described in Section 3 were done on a regional scale and may not provide accurate site-specific data for the saturated zone beneath the proposed repository. Section 3 provides general statements about ground water data, but fails to inform the reader about aquifer-specific data, such as the length of time data have been collected on the carbonate aquifer and the number of wells sampled over various periods of time. This information is particularly important for modeling the transport of radionuclides in the saturated zone.
- 22... EPA has previously discussed with DOE and NRC the calculations used to determine whether applicable radiation standards are met; determining whether the standard is met requires DOE to project the concentration of radionuclides in the water at the point of compliance. In order to do this, DOE must identify various scenarios for the type and quantity of waste released over time, transport path, and the concentrations predicted for the various options for representative volumes

- 22 cont. of ground water (e.g. 10 to 1,285 acre feet), at the various distances selected as possible points of compliance. We did not find this data identifiable in the draft EIS and suggest that the final EIS provide a discussion of this information and a summary table.

#### Section 3.1.4, Specific Hydrology Comments

- 23 Page 3-41, Section 3.1.4.2.2: This section describes the Topopah Spring tuff unit, in which the repository will be built, as fractured, very permeable, and extensively interconnected; and, perched water forms at its contact with the underlying Calico Hills non-welded unit. Page 3-48 states that water chemistry analysis has found that "perched water reached its current depth with little interaction with rock. This, in turn, provides strong evidence that flow through faults and fractures is the primary source of perched water." The final EIS should address this concern: if seismic activity occurred at these fault zones, water could move faster (or slower) through the faults and fractures, possibly increasing the mounding of perched water. This is different than the "upwelling" referred to on page 3-49.

- 24 Page 3-46: The final EIS should provide an up-to-date analysis of the chlorine-36 transport data.

- 25 Page 3-49: Lower carbonate aquifer. Since data are limited, the EIS should not conclude that the lower carbonate aquifer has an upward gradient. Page 3-51 states that there is only one transmissivity value based on tests from a single well. Also, on page 3-52, it seems preliminary to count this aquifer as a possible source of inflow to the volcanic aquifers. The final EIS should acknowledge the limited confidence that can be placed on the gradient interpretation with the data currently available.

- 26 Page 3-52: The final EIS should provide data from the ongoing investigations on the cause of the potentiometric difference north and south of the site, and it should describe what these data suggest about the potential for water from the north to flood the repository.

- 27 Page 3-57: In the discussion about water levels in the 7 wells, the significance of their proximity or distance to Fortymile Wash is unclear.

- 28 Page 3-63, Section 3.1.5.1.4: This section states that "Fortymile Wash and some of its tributaries might be classified as Waters of the U.S..." It is likely that Fortymile Wash is a Water of the U.S., as well as the Amargosa River and its tributaries: Yucca Wash, Drill Hole Wash, Midway Valley Wash, Busted Butte Wash, Solitario Canyon Wash, and Crater Flat. Also, tributaries to the washes stated above may meet the Waters of the U.S. criteria, per U.S. Army Corps of Engineers assessment.

#### Other Section 3 issues

- 29 Page 3-31: We are confused about the discussion of the Amargosa River system and the statement that there is a ground water discharge near Beatty, NV. The final EIS should clarify the direction of the ground water flow which, according to Figure 3-13 (page 3-38), does not appear to be in the direction of Beatty.



- 30 Page 3-79, Section 3.1.8: The assessments of impacts to the local populations appropriately focus on the current demographics of the area. However, there should also be some consideration given to short-term (~20 years) projections of population and land use, particularly in the area directly south of the repository where potential receptors are located. While the National Academy of Science (NAS) recommends against long term (thousands of years) projections of population characteristics, the changing demographics in the greater region around the site argue for considering a reasonable compromise between long term projections and a static situation, such as extending local planning projections for a decade or two. For example, projections of growth at the 20-kilometer location indicate modest population increases.
- 31 Page 3-82, second full paragraph: The DOE's value of 0.0005 latent cancer fatalities per person-rem is lower than the Federal Guidance level of 0.000575 latent cancer fatalities per person-rem (Table 7.3, page 174, Federal Guidance Report 13, "Cancer Risk Coefficients for Environmental Exposure to Radionuclides," EPA 402-R-99-001, September 1999). Since DOE was one of the funding, reviewing, and approving agencies for this study, EPA recommends that the Federal guidance level be used.
- 32 Page 3-142, Section 3.3.3: This section states that, "DOE calculated the river flow past each population center...and used this number in the calculation to determine dose to the population." The final EIS should provide the dose calculation used.
- 33 Page 3-142, Sections 3.3.2 and 3.3.3: The draft EIS briefly discusses ground and surface water impacts, but we were unable to find an assessment of ground water contamination from a surface spill. The transportation impacts analysis should consider ground water recharge zones and the proximity of transportation corridors to ground water supplies and community water systems.

#### **Section 4. Environmental Consequences of Repository Construction, Operation and Monitoring, and Closure**

##### Section 4.1.3, Impacts to Hydrology

- 34 Page 4-24: Activity in drainages and washes may require a Section 404 permit if it takes place in Waters of the U.S.
- 35 Page 4-25, Section 4.1.3.3: The assessment of impacts to ground water should reference the discussion on radionuclide transport in ground water in Section 5.2. Readers may be confused by the page 4-25 discussion which focuses on the impact from spills and the potential for a contaminant to infiltrate and percolate through the unsaturated zone, rather than on the full range of ground water contamination.

##### Other Ground Water Concerns

- 36... Container breaches. The final EIS should discuss the expected scenarios for container breaches and the associated impacts on ground water, taking into account ground water contamination

- 36 cont. levels at various distances and under various repository loadings. These analyses should cross-reference discussions on impacts to ground water.
- 37 Impact on ground water from transport spills. The draft EIS assesses the impact of spills on surface water, but the final EIS should also assess ground water contamination from a surface spill. The transportation impacts analysis should consider ground water recharge zones and the proximity of transportation corridors to ground water supplies and community water systems.
- Section 4.1.4, Biological Resources
- 38 Page 4-30, Section 4.1.4.2: This section states that "routine releases of radioactive materials from the repository would consist of radioactive noble gases, principally isotopes of krypton and radon." Does DOE have any examples of where these types of releases are currently occurring? If so, are they monitored and have there been any impacts to biologic communities?
- 39 Page 4-33: DOE should plan to construct the evaporation ponds with side slopes or a ramp to facilitate wildlife use.
- 40 Page 4-35: While the impact on the threatened desert tortoise population is unclear (see comment on section 6.3.1.1), EPA questions whether the impact should be rated as low or very low. Some federally listed desert tortoises were killed during site characterization and more will likely be killed during construction, operation and monitoring, and closure. With increased human activity and traffic over the life of the project, the increases may be significant. EPA notes that DOE is obtaining a Biological Opinion from the Fish and Wildlife Service (page 4-33); any mitigation/conditions for protecting the tortoise should be listed in the final EIS.

## **Section 5. Environmental Consequences of Long-Term Repository Performance**

### **41... Long-Term Repository Performance: General Comment**

EPA disagrees with certain aspects of the performance assessment described in Section 5 and in Appendix I. The Total System Performance Assessment, presented in the Viability Assessment for Yucca Mountain and captured in the draft EIS analysis, relies in some instances on extreme performance cases which either omit or overestimate certain effects.

EPA recommends using an approach -- reasonable expectation -- which focuses on a more realistic depiction of repository performance and which recognizes the inherent uncertainties in projecting repository performance over the long term. This more realistic approach projects the expected behavior of the waste containment and isolation system, but avoids extreme assumptions and use of unrealistic performance scenarios.

We believe the final EIS would be strengthened by identifying the more conservative assumptions used in the assessment. Identifying these would give the reader a better sense of the variability inherent in the estimates of repository performance and provide the public with a more balanced

41 cont. | performance projection.

Section 5.1, Inventory for Performance Assessment Calculations

- 42 Table S-1 on page 5-5 and the related discussion in sections 5.1 and 8.3.1.2.3 (Atmospheric Radioactive Material Impacts) fail to consider post-closure releases of radon from the spent nuclear fuel in the time period beyond 10,000 years. EPA's proposed standards for Yucca Mountain at 40 CFR Part 197 require an analysis of the dose to a reasonably maximally exposed individual for the period beyond 10,000 years through the time of peak dose (64 FR 46976, August 27, 1999). The National Academy of Sciences' Yucca Mountain panel in 1995 estimated that the Yucca Mountain site would be stable on the order of one million years. The final EIS must therefore discuss releases of radon-222 ( $^{222}\text{Rn}$ ), which will result from the decay of the considerable inventory of uranium in the spent nuclear fuel.
- 43 Section 5.5 (Atmospheric Radiologic Consequences) concludes that carbon-14 ( $^{14}\text{C}$ ) is the only radionuclide that has the potential for transport through the atmosphere. Likewise, section 8.3.1.2 addresses only  $^{14}\text{C}$  releases with respect to cumulative impacts. The draft EIS does examine the exposures to workers and offsite individuals from radon as a result of various operations. However, as noted by Sullivan and Pescatore ("Release of Radon Contaminants from Yucca Mountain: The Role of Buoyancy Driven Flow," T.M. Sullivan and C. Pescatore, Brookhaven National Laboratory, BNL-52468, February 1994):
- "Barometric and wind pumping at Yucca Mountain may cause long-term  $^{222}\text{Rn}$  removal from the oxidized spent fuel waste. The problem of enhanced  $^{222}\text{Rn}$  release to the accessible environment would pose itself later in time (after 20,000 years and peaking in roughly 200,000 years) and would last for as long as unsaturated conditions would prevail at Yucca Mountain."
- 44 EPA's analysis of spent fuel radionuclide inventories in support of the promulgation of 40 CFR Part 191 (see EPA 520/4-79-007A, 1977) indicates a  $^{222}\text{Rn}$  content of about 1 curie per metric ton of heavy metal, at 100,000 years following discharge from a light water reactor. This would imply a repository inventory for  $^{222}\text{Rn}$  of about 63,000 curies at about 100,000 years for the currently authorized Yucca Mountain repository. Because of its energetic radiations and numerous daughter radionuclides,  $^{222}\text{Rn}$  presents a significantly larger risk per unit of radioactivity than  $^{14}\text{C}$ .
- 45 Section 5.5 also indicates (introductory paragraph) that impacts for the global population were estimated. What value was used for the projected collective dose received by the global population?
- 46 Page 5-5: The final EIS should explain the statement on page 5-5 that chemically toxic materials were eliminated from consideration because "their total quantity would be very low and dilution in the repository environment would reduce their concentration to below toxic levels before they entered the saturated ground water system."

- 47 Page 5-13: Section 5.2.3.4 discusses the different paths radionuclides can take, but should discuss pathways through the alluvial, volcanic and carbonate aquifers.

### Section 5.3. Locations for Impact Estimates

- 48 Page 5-23: This section states "Because of this pressure difference, water from the volcanic aquifer does not flow into the carbonate aquifer; rather the reverse occurs." This statement relies on just one data point in the carbonate aquifer. In Chapter 3, this uncertainty was noted. One data point does not provide certainty, and the EIS should not assume that the entire carbonate aquifer has an upward gradient, given the amount of fracturing and faulting involved. Nor should the EIS state that no contamination will occur at Ash Meadows, since Chapter 3 noted that it was a discharge point.
- 49 Page 5-27, second paragraph and Page 5-31, bottom paragraph: Page 5-27 states that 22 acre-feet of water per year infiltrate through the repository, while page 5-31 cites 25 acre-feet. Which value is correct?
- 50 Page 5-43, Section 5.7.2, second paragraph: It would be helpful to have a graphic representation of the results of the volcanic activity analyses.
- 51 Page 5-44, first paragraph: It is difficult to understand the first part of this paragraph. Please explain the sentence: "Because of its low velocity, the magma would not be removed from the waste package."

## **Section 6. Environmental Impacts of Transportation**

### National Transportation Impacts.

- 52 Section 6.2.1: This section describes how the EIS bounds the impacts to human health, safety and the environment from transportation by examining the two extremes of transportation possibilities - mostly rail and mostly legal-weight truck. Based on DOE's analysis, EPA agrees with DOE's overall assessment that radiological impacts to the public from transportation of wastes to Yucca Mountain will be small.
- 53 In addition, the EIS recognizes the need to prepare for and respond to accidents. Page 6-30 highlights section 180(c) of the Nuclear Waste Policy Act under which DOE will provide technical assistance and funding to state, local and tribal public safety programs on transportation emergencies. This page also describes how transportation contractors must prepare an emergency response plan and take other steps to deal with the consequences of accidents.
- 54... EPA appreciates that the actual shipments of waste will not likely occur for another 10 years and understands DOE's reluctance to provide additional information on likely routes for waste transport. However, EPA sees no reason why DOE cannot commit to making this information available as the time for shipments approaches. DOE is doing this now for shipments to the

- 54 cont. Waste Isolation Pilot Plant in New Mexico. Once DOE has greater certainty about the routes along which waste shipments will travel, the Department will also be able to update and expand upon, if needed, the environmental justice or other impact analyses which are route-specific.
- 55 In addition, EPA suggests that the final EIS provide a section which lays out the responsibilities of various federal, state, local and tribal agencies in regulating, approving and monitoring shipments of nuclear waste. This information should provide additional assurance to the public that a national network of controls is in place designed to ensure public safety.
- 56 Page 6-17, Section 6.1.3, second paragraph: The next-to-last sentence says that "an air quality conformity analysis [for carbon monoxide] may be required." If a conformity determination is needed, it should be made before completion of the NEPA process. EPA suggests such information be included in the final EIS.
- 57 Page 6-20, third bullet: The term "dose risk" is not a standard term. What does it mean when used in the phrase, "to estimate radiological dose risk to populations"?
- 58 Page 6-38, Section 6.3.1.1: DOE recognizes that desert tortoises will be killed as a result of transportation operations. The Department reaches the conclusion that "any desert tortoises killed by trucks transporting spent nuclear fuel or high-level radioactive waste probably would be only a small fraction of all desert tortoises killed on highways." This may be true, but what is the anticipated impact of this operation relative to the desert tortoise population on the Nevada Test Site (NTS)? The higher concentration of shipments on the NTS could result in a proportionately higher impact than in the general environment. However, it may be possible that the impact on the tortoise population might be less than in the general environment since the NTS has a protection program in place. See also EPA comment on page 4-35.

## Section 7. Environmental Impacts of the No-Action Alternative

- 59 Page 7-38, end of the first partial paragraph: EPA appreciates that for comparison purposes and to avoid the appearance of bias toward the preferred alternative, "DOE did not want to overestimate the impacts from Scenario 2." However, the document should provide an estimate or a range of impacts for the reader.

## Section 8. Cumulative Impacts

- 60 Page 8-27, Section 8.2.2.1.2: This section refers to 40 CFR Part 61 which contains EPA's Clean Air Act regulations for radiological effluents from a variety of facilities; however, this rule is not applicable to Yucca Mountain. More appropriate references are 40 CFR Part 191, Subpart A (Environmental Standards for Management and Storage, 50 FR 38066, September 19, 1985) or proposed 40 CFR Part 197, Subpart A (Environmental Standards for Storage), both of which address airborne radiological releases and external exposures from Yucca Mountain during the operational period.

- 61 Page 8-47, Table 8-22: This table and several other tables in section 8 list "MEI dose (millirem)", but do not indicate whether this dose occurs in one year or over the total closure period. Some of the doses are rather large compared to established radioactive waste standards, such as the 58 millirem listed for the MEI dose for Inventory Module 1 or 2. To properly judge the impact, the exposure period must be specified.
- 62 Page 8-66, Table 8-46: For Inventory Module 1, the gross alpha concentration is missing.
- 63 Page 8-74, Item 7 and the final paragraph: This item, *Greater Confinement Disposal* (GCD), does not indicate that there is transuranic radioactive (TRU) waste at the Nevada Test Site, in addition to low-level radioactive waste (LLW). The final EIS should so note since the TRU waste has a greater potential for adding to the impact from Yucca Mountain than does the LLW.
- 64 Page 8-75, Table 8-55: Out of the 9.3 million curies in GCD, tritium and americium are the only ones identified as "major or known isotopes." DOE needs to state the basis for determining a "major isotope."
- 65 Page 8-77, Section 8.3.2.1.2: This section assumes that the risk of radiological impacts is directly scalable to the radiological content of the waste disposed in the GCD facility. However, the GCD wastes are disposed in a different manner than that contemplated for the Yucca Mountain repository (namely, closer to ground surface) and the source term likely contains a different mixture of radionuclides than anticipated for disposal at Yucca Mountain; therefore, relating the risk of GCD disposal to its inventory is overly simplistic and should be re-examined.

## Section 9. Management Actions to Mitigate Potential Adverse Environmental Impacts

### Design Changes

- 66... Pages 9-12 through 9-16, Section 9.2.8: The design alternatives discussed in this section are outdated with the Department's adoption of the EDA II design. The final EIS should discuss the new design of the engineered barrier components (e.g., elements designed to minimize water contact with the packages, increase containment lifetime, or retard radionuclide movement out of the repository); it should also discuss the operational choices (e.g., a prolonged retrievability period) that dictated the design changes and reduced uncertainties in assessing performance of the system.

The final EIS should also contrast significant changes in the engineered barrier performance assessment with the assessments for the older design. For example, the DOE/VA design assumed a juvenile package failure at 1,000 years, a major contributor to the dose calculations within 10,000 years. Estimating the rate and timing of juvenile failures is very difficult since the failure mechanisms are hard to predict. With the addition of drip shields, this uncertainty is effectively eliminated since releases would only occur if a drip shield is breached over a package with a juvenile failure - a very low-probability event.

66 cont. The performance assessment of the new design should describe the string of processes and events needed to release radionuclides, e.g., the probability that a drip shield would prematurely fail, the probability that a waste package would prematurely fail, the probability that these failures would be co-located, and the probability that a ground water seep would be located over the failed drip shield. A presentation in the final EIS that describes the new design in terms of its expected performance can help justify the design change, support the bounding argument for the older design, and increase confidence in the repository assessments.

Tribal Coordination/Consultation (various sections and appendices)

67 Page 9-22: This section refers to the Yucca Mountain Project Native American Interaction Program for promoting a government-to-government relationship with area tribes. Pages C-7 to C-9 also discuss DOE's interaction with tribal governments on the proposed project. Representatives from the "Consolidated Group of Tribes and Organizations" have met with DOE on a range of issues. The Consolidated Group includes Southern Paiute Tribes, Western Shoshone Tribes, Owens Valley Paiute and Shoshone Tribes, and the Las Vegas Indian Center. EPA commends DOE's efforts to work with Tribes within Nevada and neighboring states, but we also encourage DOE to inform and reach out to other Tribes which may be affected by waste shipments.

Shipments of spent nuclear fuel and/or DOE high-level radioactive waste may cross Tribal lands in various parts of the country, and if DOE has not already done so, we encourage the Department to commence a government-to-government consultation process with such Federally-recognized Tribes. In order to facilitate public and agency disclosure under NEPA, the final EIS should identify those Tribes which may be affected by the transportation of waste across or close to Tribal land. This discussion should also include any potential effects on tribal resources.

68 The draft EIS (Figures 2-26 and 2-27) depicts U.S. interstate and rail routes which are potential corridors for waste proposed for disposal at Yucca Mountain. We recommend that the final EIS provide a modified overlay of these two figures to depict Tribal lands through which waste bound for disposal at Yucca Mountain may pass via road or rail. The Bureau of Indian Affairs (BIA) has a 1993 map for Indian Land Areas in the lower 48 states. This map depicts the location of tribal lands in relationship to the Federal highway network, and may be useful for this effort.

69 Pages 3-68 through 3-70: This section discusses tribal historical and cultural beliefs but provides little information on how Native Americans think the proposed project may affect their cultural resources. Page 3-70 refers to a resource document prepared by the American Indian Writers Subgroup, but does not summarize the concerns therein or explain how to obtain a copy of the document.

70 We also note that while Appendix D indicates that the draft EIS was distributed to the Department of the Interior's Office of Environmental Policy and Compliance (Dr. Willie R. Taylor), it does not appear that a copy was sent directly to the Bureau of Indian Affairs (BIA). We recommend that the Department of Energy provide the BIA with a copy of the final EIS.

## Section 11. Statutory and Other Applicable Requirements

### Pages 11-6 and 11-7, Nevada Water Quality Standards

- 71 It is unclear whether the draft EIS has fully analyzed potential water quality impacts of the proposed project (especially the environmental consequences of long-term repository performance) per Nevada water quality standards. The final EIS should provide this analysis and discuss any needed mitigation.
- 72 Section I.3.2 states that waterborne chemically toxic materials that could threaten human health are present in materials disposed of in the repository, the most abundant being uranium, as well as nickel, chromium and molybdenum (used in the waste package). EPA agrees with the analysis on page 5-6 of the conditions under which waste materials disposed at Yucca Mountain could threaten human health: (1) the waste packages and their contents are exposed to water, (2) radionuclides and/or chemically toxic materials in the package materials or wastes become dissolved or mobilized in the water, and (3) radionuclides or chemically toxic materials are transported in water to an aquifer; further, such water must be withdrawn via a well or surface discharge point and used by humans as drinking water or in the human food chain.
- 73... Pages 11-6 and 11-7 of the Draft EIS highlight several important requirements of the Federal Clean Water Act (CWA) and Nevada's Revised Statutes which were passed to carry out the legislative requirements of the CWA and EPA's regulatory programs. The draft EIS recognizes the CWA Section 313 requirement that any project or activity by a Federal department or agency resulting (or which may result) in the discharge or runoff of pollutants comply with Federal, State, local and interstate water pollution requirements. Water Quality Standards are designed to protect both existing and designated beneficial uses of a water body. The Water Quality Standards adopted by the State of Nevada and approved by U.S. EPA require that:
- The water must be suitable for the watering of livestock without treatment.
  - The water must be suitable as habitat for fish and other aquatic life existing in a body of water.
  - The water must be suitable for propagation of wildlife and water fowl without treatment.
  - The unique ecological or aesthetic value of the water must be maintained.
  - The water must support natural enhancement or improvement of water quality in any water which is downstream (see NAC 445A.122, approved by U.S. EPA under authority of the Federal CWA).
- Page 3-31 describes the hydrologic system of the Yucca Mountain region, noting that the Amargosa River system drains Yucca Mountain and surrounding areas. The Yucca Mountain regional groundwater system includes "discharge points," defined as "locations where groundwater reaches the surface." The draft EIS notes that groundwater discharges to channels near Beatty, Nevada, south of Tecopa, California, and in southern Death Valley, California. (See also EPA's question about the Beatty discharge point under Section 3 issues.)
- Because the Amargosa River flows into Death Valley, California (p. 3-31), it is presumably an interstate water regulated by Nevada water quality standards (NAC 445A.213(5)). These standards provide that "Radioactive materials attributable to municipal, industrial or other controllable sources must be at the minimum concentrations which are physically and



- 73 cont. | economically feasible to achieve. In no case must materials exceed 1/10 of the 168-hour values for other radioactive substances specified in National Bureau of Standards Handbook 69.”  
Regarding radioactive materials, the Water Quality Standards stipulate that “...concentrations in water must not result in accumulation of radioactivity in plants or animals that result in a hazard to humans or harm to aquatic life” ( NAC 445A.121(6)).

California Water Quality Standards

- 74 | Page 3-31 states that ground water reaches the surface at three locations, including one in southern Death Valley, California. However, the draft EIS does not discuss whether any potential migration and subsequent discharge of contaminated groundwater from the project (from repository construction, operation, closure, or long-term performance) would be consistent with the State of California’s Water Quality Standards for this geographic area. The final EIS should provide this analysis and discuss any needed mitigation.
- 75 | The relevant California standards are in the Water Quality Control Plan for the Lahontan Region, developed by the California Regional Water Quality Control Board, approved by EPA and last updated in October 1994. This Plan identifies water quality objectives for surface waters; specifically, page 3-6 of the Plan specifies “Radionuclides shall not be present in concentrations which are deleterious to human, plant, animal, or aquatic life nor which result in the accumulation of radionuclides in the food web to an extent which presents a hazard to human, plant, animal, or aquatic life.” The Plan further provides that waters with a designated beneficial use of “MUN” (waters used for community, military or individual water supply systems) shall not contain a concentration of radionuclides in excess of the limits specified in Table 4, Section 64443 (radioactivity) of Title 22 of the California Code of Regulations.

The Plan identifies larger hydrologic units (such as the Amargosa Hydrologic Unit and the Death Valley Hydrologic Area), and geographically smaller subunits (such as the Tecopa Wetlands, and minor surface waters and minor wetlands in the Death Valley Hydrologic Area), and lists specific beneficial uses that must be protected. Beneficial uses for the Tecopa Wetlands include municipal and domestic water supply, freshwater habitat, wildlife habitat, preservation of biological habitats of special significance, habitat for rare, threatened and endangered species, migration of aquatic organisms, and water quality enhancement. Many of these same beneficial uses also apply to the minor surface waters and minor wetlands of Death Valley, which in addition are designated beneficial uses of ground water and fresh water replenishment.

Compliance with Resource Conservation and Recovery Act (RCRA ), Page 11-11

- 76... | Mixed radioactive and hazardous waste is subject to RCRA requirements, including applicable permitting requirements. The draft EIS states that DOE will not accept hazardous waste for disposal at Yucca Mountain and that any hazardous or mixed waste which is generated will not be treated or disposed on-site, nor will it be stored for more than 90 days. Accordingly, “DOE does not expect to need a Resource Conservation and Recovery Act permit for its activities at the proposed repository.”

76 cont. Page 1-7 of the draft EIS indicates that high-level wastes from DOE sites would be immobilized through vitrification before shipment to Yucca Mountain. Vitrification meets the RCRA Land Disposal Restriction treatment standard for these wastes. Various DOE documents indicate that organic solvents and hazardous chemicals, in addition to toxic heavy metals, are typically contained in high-level radioactive waste. The final EIS should explain why the high-level waste to be disposed of at Yucca Mountain will not be RCRA regulated.

77 The final EIS should also clarify the applicability of RCRA to the data presented in Table I-10 (page I-15) in Volume II, "Inventory [kilograms] of Chemical Materials Placed in the Repository under the Proposed Action." Under "high-level radioactive waste" the table lists 19,000 kilograms of barium, 43,000 kilograms of cadmium, 2,000 kilograms of lead, 200 kilograms of mercury, and 300 kilograms of selenium. Pursuant to RCRA, EPA has established regulatory levels (mg/L) for barium (100.0 mg/L), cadmium (1.0 mg/L), lead (5.0 mg/L), mercury (0.2 mg/L), and selenium (1.0 mg/L). (See 40 CFR 261.24, Toxicity Characteristics.)

#### PCBs and Asbestos

78 Section 11 of the draft EIS does not discuss the applicability of the Toxic Substances Control Act or of regulations governing asbestos disposal. The final EIS should clarify whether any waste proposed for disposal at Yucca Mountain is or may be contaminated with PCBs (polychlorinated biphenyls), or whether any radioactive asbestos waste is destined for disposal at Yucca Mountain, and, if so, the regulatory implications of such.

#### Other Section 11 Comments

79 Page 11-18, Table 11-2: The table should include DOE Order 435.1 which applies to this action unless the requirements of the order "overlap or duplicate" requirements of the Nuclear Regulatory Commission (NRC).

80 Page 11-20, Table 11-3: The table should list 40 CFR Part 191, Subpart A (Environmental Standards for Management and Storage) which applies to certain areas in the vicinity of the proposed Yucca Mountain repository.

#### **Section 14. Glossary**

81 Page 14-8, definition of "controlled area": This definition is inconsistent with how this term is used in 40 CFR Part 191 (see 50 FR 38085, September 19, 1985) and in proposed 40 CFR Part 197 (64 FR 47013, August 27, 1999). The definitions in EPA's rules limit the controlled area size to no more than five kilometers from the repository footprint. (There is an additional option in proposed 40 CFR Part 197 with which this definition is also inconsistent.) EPA recognizes that the size of the controlled area for physical control purposes during the active institutional control period might be different than the area used for performance assessment purposes, but if so, the distinction should be clarified on page 14-8 and in the appropriate places in the final EIS.

- 82 Page 14-19, definition of "inadvertent intrusion": The word "unintended" needs to be inserted before "disturbance," i.e., "The *unintended* disturbance of a disposal facility ...." As currently written, the definition would include purposeful intrusions.
- 83 Page 14-19, definition of "institutional control": This definition should distinguish between "active institutional control," which requires the presence of humans to take actions to safeguard and repair the repository, and "passive institutional control," which also includes controls such as permanent markers and land records to warn future generations of dangers from the disposal site.
- 84 Page 14-22, definition of "maximally exposed individual": The last sentence of this definition equates the maximally exposed individual (MEI) with the "reasonably maximally exposed individual (RMEI)," a term used in the recently proposed 40 CFR Part 197 (see 64 FR 46988 and 47014/47015, August 27, 1999). These two terms are very different. The dose incurred by the MEI is calculated by using the most conservative values (i.e., producing the highest dose) for all parameters needed to calculate the dose to an individual. The dose incurred by the RMEI, on the other hand, assumes that one or a few parameters are at their maximum or most conservative values while the others are at their average values.
- Page 14-29, definition of "reasonably maximally exposed individual": See previous comment.

#### **Appendix I. Environmental Consequences of Long-Term Repository Performance**

- 85 Page I-49, fourth full paragraph: The document described in the final sentence should be referred to as Federal Guidance Report No. 11.
- 86 Page I-111, last reference. Please replace the authors' names in the first column with the EPA report number.

#### **Appendix J. Transportation**

- 87 Page J-8, second full paragraph: This paragraph discussed the methodology used to estimate the radiation impact resulting from accidents. The spectrum of possible accident severity was divided into categories. Then "each category of severity received a conditional probability of occurrence." A release fraction was assigned to each category. Please provide a brief discussion of how values were assigned and a table listing the values.

#### **Appendix K. Long-Term Radiological Impact Analysis for the No-Action Alternative**

- 88 Page K-7, Figure K-3: This map shows failure times for above-ground concrete storage modules. The no-action impact analysis looked at a 100-year time frame, yet Figure K-3 indicates that in some areas of the country, failure could be expected in less than 75 years and, in other areas, between 75-100 years. The final EIS should evaluate the premature failure potential for those areas of the country where such could be expected in less than 100 years.
- 89... Page K-26, Section K.2.5.2: This section discusses the potential for criticality involving stored

89 cont. spent fuel. EPA agrees with the assessment that criticality for high-level nuclear waste is impossible, but believes the EIS should expand the assessment of low probability for criticality in stored spent fuel canisters. The text states that only water entry, and its retention in the canisters, would allow a criticality to develop; and, the discussion further acknowledges the possibility of degradation of the concrete storage facilities, allowing water entry. Yet, the text does not assess the probability that dripping water could corrode the fuel containers, allowing water to enter and remain there for some time, potentially causing a criticality.

The text discusses three types of criticality events, but does not connect them to more explicit container corrosion failures scenarios or evaluate the relative probabilities of each failure type. DOE should more explicitly analyze corrosion failures (penetration of the container and corrosion of the internal components) from water entering the storage container and the potential for various criticalities. It is plausible that dripping water could corrode a storage container, allowing water to collect and fill the container (a scenario similar to NRC's performance scenario for a breached waste package in the repository).